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(11)

EP 0 824 130 A2

(12)

EUROPEAN PATENT APPLICATION

(43) Date of publication:
18.02.1998 Bulletin 1998/08

(51) Int Cl.⁶: **C08K 3/00**, **C08K 3/32**,
C08K 5/02, **C08L 67/00**

(21) Application number: **97306127.8**

(22) Date of filing: **12.08.1997**

(84) Designated Contracting States:
**AT BE CH DE DK ES FI FR GB GR IE IT LI LU MC
NL PT SE**

(30) Priority: **12.08.1996 US 689746**

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(54) **Flame retardant polyester composition**

(57) A flame retarded resin molding composition with enhanced electrical properties comprising a polyester resin, a flame retarding amount of a halogenated

flame retardant, a mineral filler, and an effective amount of a pyro/polyphosphate, and optionally including reinforcing glass fibers or an olefinic polymer for enhancing electrical properties.

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Description

This invention relates to flame retarded resin molding compositions having a improved electrical properties.

5 **Background of the Invention**

Resins such as poly(1,4-butylene terephthalate) are used in molding compositions due to its many excellent properties, i.e. strength, solvent resistance, etc. In applications which require good electrical properties, molded parts may be exposed to severe conditions, such as exposure to electrical discharge or to excessive current leakage across its surface. These conditions require not only that the molded part have flame resistance, but also that the molded part have a high degree of resistance to carbonization upon exposure to high voltage, i.e. good track resistance and a high degree of resistance to electrical discharge.

However, it has been a problem that flame retarded polyester resins have poor track resistance compared to the non-flame retarded resin. U.S. Pat. No. 4,000,109, Smith, et al, use a metal borate to improve track resistance in flame retarded poly(1,4-butylene terephthalate) resin. U.S. Pat. No. 4,421,888, Okada, discloses a flame retarded, talc and glass fiber reinforced, polyester blend having a sustained high track resistance. U.S. Pat. No. 4,636,544 to Hepp utilizes titanium dioxide to improve the Comparative Tracking Index CTI. Glass fibers which are typically added to increase the strength of the polyester compositions have an adverse effect on CTI. U.S. Patent 4,043,971 describes the use of CaSO₄ and/or BaSO₄ as fillers for polybutylene terephthalate to give improved tracking resistance as compared to polybutylene terephthalate containing no fillers. As set forth in the patent, this is particularly surprising, since the use of similar fillers such as chalk (CaCO₃) leads to no such results.

U.S. Patent 4,296,021 relates to reinforced thermoplastic compositions that are provided comprising a high molecular weight linear polyester, and a minor proportion of aluminum silicate alone or in combination with glass fiber reinforcement. The use of the aluminum silicate elevates strength, modulus and heat deflection temperature, while retaining the inherent resistance to high voltage breakdown of the polyester resin component. U.S. Patent 4,456,723 relates to polyester molding composition having improved tracking resistance which includes a substantially water-free calcium phosphate. Hence, it is desirable to provide additional ingredients which can enhance the track resistance of glass fiber polyester composition.

30 **Summary of the Invention**

It is an object of the present invention to provide flame retarded, reinforced polyester resin molding compositions, likewise, articles molded from them which have improved electrical properties.

Another object of the present invention is to provide flame retarded polyester resin molded articles and the molding compositions which are suitable for molded electrical devices, such as electrical outlets, circuit breakers, switches, fuse holders, lamp sockets, distributor caps, or ignition coils.

According to the present invention, there are provided flame retarded resin molding compositions with enhanced electrical properties, particularly track resistance, which comprise a polyester, a flame retarding amount of a halogenated flame retardant, mineral filler, and an effective amount of a pyro/polyphosphate for improving the electrical properties. The pyro/polyphosphate may be a metal pyrophosphate, a metal polyphosphate, a metal acid pyrophosphate, or metal acid polyphosphate.

In accordance with another aspect of the present invention, an olefinic polymer is included in the composition, in addition to the pyro/polyphosphate for enhancing the electrical properties.

45 **Description of the Preferred Embodiments**

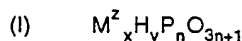
In accordance with the principles of the present invention, the combination of ingredients are selected so that the compositions are suitable for electrical connectors and have improved Comparative Tracking Index (CTI). CTI is typically measured by UL-746A or ASTM-D3638-85 or IEC-112-3rd Publication. The method of this test is intended to indicate the relative behavior of solid electrical insulating materials with regard to their susceptibility to surface tracking when exposed under electrical stress, to water, and other contaminants from the surroundings. This method is especially suitable for testing synthetic resin moldings. Comparative Tracking Index; the voltage, as determined under the conditions specified in this test method, which will cause failure with the application of 50 drops of electrolyte to the specimen, is used as a measure of the susceptibility of the material to tracking.

55 Preferably the CTI of the final composition is greater than or equal to about 400, and preferably greater than about 450 volts. Typically neat poly(1,4-butylene terephthalate) (PBT) has a CTI value of 600 volts but the addition of flame retardants and glass fibers tend to decrease the CTI value to about 200 to 250 volts. Hence, it is desirable to select the remaining ingredients so as to not detract from the desirable flame retardancy and mechanical properties but

enhance the CTI of the final composition.

Preferably, the desired flame retardancy is V-0 according to Underwriters Laboratories Test No. 94. In addition to high CTI and flame retardancy, important properties include good mechanical properties, good processability, i.e. short molding cycle times, good flow, and good insulation properties. Flame retardants and reinforcing materials such as glass fibers are desirably separate components present in the resin to enhance the flame retardant and strength properties, respectively.

In accordance with the principles of the present invention, the resin composition includes a pyro/polyphosphate selected from the group consisting of metal pyrophosphates, metal polyphosphates, metal acid pyrophosphates, metal acid polyphosphates, and mixtures thereof. Preferably the pyro/polyphosphate has the formula (I):



wherein M is a metal, x is a number from 1 to 12, y is a number from 0 to 12, n is a number from 2 to 10, z is a number from 1 to 5 and the sum of (xz)+y is equal to n+2. M is preferably a Group IA, IIA, IB or IIB metal and more preferably sodium or potassium.

These compounds include, for example, pyrophosphates of the formula $Na_3HP_2O_7$; $K_2H_2P_2O_7$; $Na_3H_2P_2O_{10}$; $KNaH_2P_2O_7$ and $Na_2H_2P_2O_7$ or sodium hexameta phosphate, $Na_6P_6O_{19}$. Typically, the metal pyro/polyphosphates are hydrates and may be in powder form. Sodium acid pyrophosphate is the most preferred.

The pyro/polyphosphate is added to the flame retarded molding compositions in an amount effective to increase track resistance but not in such amount that other essential properties of the molding composition are substantially degraded. Preferably, the final composition comprises from about 0.5 to about 40, and more preferably from about 0.5 to about 20 percent of the pyro/polyphosphate for improving the CTI.

Additionally, it has been found that olefinic type polymers may be added to provide enhancement of the CTI. Typical olefinic type polymers are the addition polymers of olefins. Suitable olefins include ethylene, propylene, butylene, hexene and octene or their copolymers.

Polyolefins may be high density polyethylene (d=above 0.94), low density polyethylene (d=about 0.92), linear low density polyethylene (d=0.916-0.940) or polypropylene. The olefin polymers may be copolymers, including ethylene-propylene copolymers and those containing acid or ester structural units derived, for instance, from acrylic acid, methacrylic acid, acrylic esters, methacrylic esters, alkyl vinyl esters or the like, most often in the amount of about 5-25%, preferably 10-25 percent by weight. Most preferred are copolymers of ethylene with an alkyl acrylate or alkylmethacrylate such as ethyl acrylate or methacrylate.

Preferably, olefinic type polymers are included in the final composition in an amount from about 1 to about 10, and more preferably from about 3 to about 7 percent by weight of the final composition as an effective amount to improve the CTI.

Included in the resin compositions of the present invention are mineral filler materials which act with the pyro/polyphosphates to enhance the track resistance. The preferred mineral fillers enhance the CTI. Typical mineral fillers include metal sulfates, micas, clays such as aluminosilicates and aluminosilicates, talcs, glass flake, wollastonite, metal oxides such as titanium dioxide, zinc sulfide, ground quartz, and the like. Preferred mineral fillers are the talc, clays and metal sulfates. Typical silicates include calcium silicates such as Wollastonite; aluminum silicates such as Kaolin which is a clay material composed of fine-grained mineral kaolinite; hydrated magnesium silicates known as Talc; silica and alumina type mineral materials, and Mica which is a hydrous aluminosilicate material. Clay is a hydrated aluminum silicate generalized by the formula $Al_2O_3SiO_2 \cdot xH_2O$.

The metal sulfate salts as well as their hydrates are preferred mineral fillers. Preferred metal sulfate salts are the Group IA and Group IIA metal sulfates with barium, calcium and magnesium sulfates being preferred.

Barium sulfate which is non-toxic and insoluble in dilute acids is especially preferred. Barium sulfate may be in the form of the naturally occurring barytes or as synthetically derived barium sulfate using well known synthetic techniques. The particle size may vary from 0.5 to 50 microns, preferably from 1 to 15 microns and most preferably 8 microns.

In most applications, the pyro/polyphosphates, mineral filler, and reinforcing material such as glass fibers, comprise the filler material, and desirably represent 5 to 70% and preferably from 10 to 50% of the total weight percent of the composition. Based on the total weight of the composition, reinforcement material is preferably present in an amount from 5 to 30 percent by weight, mineral filler in an amount from 3 to 30 percent by weight and pyro/polyphosphate in an amount from 0.5 to 20 percent by weight.

To provide desired stiffness, the reinforcing material is desirably a glass fiber reinforcing agent. As previously discussed, the inclusion of glass fiber deleteriously reduces the CTI. Hence, other constituents are desirably selected to enhance the CTI.

The glass fiber or filamentous glass is employed as a reinforcement in the present compositions. For compositions ultimately to be employed for electrical uses, it is preferred to use fibrous glass filaments comprised of borosilicate

glass that is relatively soda-free. This is known as "E" glass. The filaments are made by standard processes, e.g., by steam or air blowing, flame blowing and mechanical pulling. The preferred filaments for plastic reinforcement are made by mechanical pulling. The filament diameters preferably range from about 3 to 30 microns.

The length of the glass filaments and whether or not they are bundled into fibers and the fibers bundled in turn into yarns, ropes or rovings, or woven into mats and the like are also not critical to the invention. However, in preparing the molding compositions it is convenient to use the filamentous glass in the form of chopped strands of from about 1/8" to about 1/2" long. In articles molded from the compositions on the other hand, even shorter lengths will be encountered because, during compounding considerable fragmentation will occur.

The amount of flame-retardant additive should be present in an amount at least sufficient to reduce the flammability of the polyester resin, preferably to a UL94 V-0 rating. The amount will vary with the nature of the resin and with the efficiency of the additive. In general, however, the amount of additive will be from 2 to 20 percent by weight based on the weight of resin. A preferred range will be from about 5 to 15 percent.

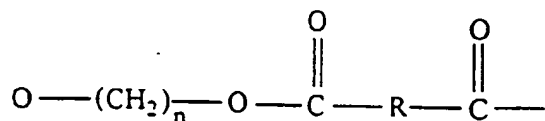
Typically halogenated aromatic flame-retardants include tetrabromobisphenol A polycarbonate oligomer, polybromophenyl ether, brominated polystyrene, brominated BPA polyepoxide, brominated imides, brominated polycarbonate, poly (haloaryl acrylate), poly (haloaryl methacrylate), or mixtures thereof. Poly (haloaryl acrylate) is preferred with the most preferably being poly (pentabromobenzyl acrylate). PBB-PA has been known for some time, and is a valuable flame-retardant material, useful in a number of synthetic resins. PBB-PA is prepared by the polymerization of pentabromobenzyl acrylate ester (PBB-MA). The PBB-PA polymeric flame-retardant material is incorporated into the synthetic resin during processing to impart flame retardant characteristics.

Examples of other suitable flame retardants are brominated polystyrenes such as polydibromostyrene and polytribromostyrene, decabromobiphenyl ethane, tetrabromobiphenyl, brominated alpha, omega - alkylene-bis-phthalimides, e.g. N,N'-ethylene-bis-tetrabromophthalimide, oligomeric brominated carbonates, especially carbonates derived from tetrabromobisphenol A, which, if desired, are end-capped with phenoxy radicals, or with brominated phenoxy radicals, or brominated epoxy resins. Other aromatic carbonate flame retardants are set forth in U.S. Patent 4,636,544 to Hepp.

The flame retardants are typically used with a synergist, particularly inorganic antimony compounds. Such compounds are widely available or can be made in known ways. Typical, inorganic synergist compounds include Sb_2O_5 , Sb_2S_3 , and the like. Especially preferred is antimony trioxide (Sb_2O_3). Synergists such as antimony oxides, are typically used at about 0.5 to 15, and more preferably from 1 to 6 percent by weight based on the weight percent of resin in the final composition.

Also, the final composition may contain polytetrafluoroethylene (PTFE) type resins or copolymers used to reduce dripping in flame retardant thermoplastics.

Suitable polyester components include crystalline polyesters such as polyesters derived from an aliphatic or cycloaliphatic diols, or mixtures thereof, containing from 2 to about 10 carbon atoms and at least one aromatic dicarboxylic acid. Preferred polyesters are derived from an aliphatic diol and an aromatic dicarboxylic acid having repeating units of the following general formula:



wherein n is an integer of from 2 to 6. R is a C_6 - C_{20} aryl radical comprising a decarboxylated residue derived from an aromatic dicarboxylic acid.

Examples of aromatic dicarboxylic acids represented by the decarboxylated residue R are isophthalic or terephthalic acid, 1,2-di(p-carboxyphenyl)ethane, 4,4'-dicarboxydiphenyl ether, 4,4' bisbenzoic acid and mixtures thereof. All of these acids contain at least one aromatic nucleus. Acids containing fused rings can also be present, such as in 1,4-1,5- or 2,6-naphthalenedicarboxylic acids. The preferred dicarboxylic acids are terephthalic acid, isophthalic acid, naphthalene dicarboxylic acid or mixtures thereof.

The most preferred polyesters are poly(ethylene terephthalate) ("PET"), and poly(1,4-butylene terephthalate), ("PBT"), poly(ethylene naphthanoate) ("PEN"), poly(butylene naphthanoate), ("PBN") and poly(propylene terephthalate) ("PPT").

Also contemplated herein are the above polyesters with minor amounts, e.g., from about 0.5 to about 5 percent by weight, of units derived from aliphatic acid and/or aliphatic polyols to form copolyesters. The aliphatic polyols include glycols, such as poly(ethylene glycol). Such polyesters can be made following the teachings of, for example, U.S. Pat. Nos. 2,465,319 and 3,047,539.

The preferred poly(1,4-butylene terephthalate) resin used in this invention is one obtained by polymerizing a glycol component at least 70 mol %, preferably at least 80 mol %, of which consists of tetramethylene glycol and an acid component at least 70 mol %, preferably at least 80 mol %, of which consists of terephthalic acid, or polyester-forming derivatives thereof.

5 The polyesters used herein have an intrinsic viscosity of from about 0.4 to about 2.0 dl/gas measured in a 60:40 phenol/tetrachloroethane mixture or similar solvent at 23°-30° C. VALOX Registered TM 315 polyester is particularly suitable for this invention having an intrinsic viscosity of 1.1 to 1.4 dl/g.

10 Blends of polyesters may also be employed in the composition. As indicated earlier, preferred polyesters are poly(ethylene terephthalate) and poly(1,4-butylene terephthalate). When blends of these preferred components are employed the polyester resin component can comprise from about 1 to about 99 parts by weight poly(ethylene terephthalate) and from about 99 to about 1 part by weight poly(1,4-butylene terephthalate) based on 100 parts by weight of both components combined.

15 Additional ingredients may include other thermoplastic resins in an amount up to about 50 percent by weight based on the weight of the formulation. Such other suitable thermoplastic resins which may be used include polyamides, acrylic and methacrylic polymers or copolymers; epoxy resins; polycarbonates; polyetherimides; phenylene oxide based resins such as polyphenylene oxide and blends of polyphenylene oxide and styrene resins; polyaryl ethers; polyphenylene sulfides; polyetherketones, aliphatic polyketones, polysulfones; and ordered aromatic copolymers especially liquid crystalline polymers.

20 Such additional resin compositions may include, an effective amount of any of the known impact modifiers useful for polyesters and polyester blends. These may be added to the compositions by themselves or in combination with the aforementioned aromatic polycarbonates. The preferred impact modifiers generally comprise an acrylic or methacrylic grafted polymer of a conjugated diene or an acrylate elastomer, alone or copolymerized with a vinyl aromatic compound. Especially preferred grafted polymers are the core-shell polymers of the type available from Rohm & Haas, for example Acryloid EXL2691 and Acryloid EXL3330. In general these impact modifiers contain units derived from butadiene or in combination with a vinyl aromatic compound, acrylate, or alkylacrylate ester such as methacrylate. The
25 aforementioned impact modifiers are believed to be disclosed in Fromuth, et al., U.S. Pat. No. 4,180,494; Owens, U.S. Pat. No. 3,808,180; Farnham, et al., U.S. Pat. No. 4,096,202; and Cohen, et al., U.S. Pat. No. 4,260,693, all incorporated herein by reference.

30 Additional preferred impact modifiers are of the type disclosed in U.S. Pat. No. 4,292,233, incorporated by reference. These impact modifiers comprise, generally, a relatively high content of a partially cross-linked butadiene polymer grafted base having grafted thereon acrylonitrile and styrene.

Other ingredients employed in low amounts, typically less than 5 percent by weight of the total composition, include stabilizers, lubricants, colorants, plasticizers, nucleants, antioxidants and UV absorbers. These ingredients should be selected so as not to deleteriously affect the desired properties of the molded resin.

35 Although it is not essential, best results are obtained if the ingredients are precompounded, pelletized and then molded. Precompounding can be carried out in conventional equipment. For example, after predrying the polyester resin, other ingredients, and, optionally, other additives and/or reinforcements, a single screw extruder is fed with a dry blend of the composition. On the other hand, a twin screw extrusion machine can be fed with resins and additives at the feed port and reinforcement down stream.

40 Portions of the blend can be precompounded and then, extruded with the remainder of the formulation, and cut or chopped into molding compounds, such as conventional granules, pellets, etc. by standard techniques.

45 The compositions can be molded in any equipment conventionally used for thermoplastic compositions. For example, good results will be obtained in an injection molding machine, e.g. of the 80 ton Van Dorn type, with conventional temperatures which depend on the particular thermoplastic utilized. If necessary, depending on the molding properties of the polyester, the amount of additives and/or reinforcing filler and the rate of crystallization of the polyester component, those skilled in the art will be able to make conventional adjustments in molding cycles to accommodate the composition.

50 Flammability tests were performed with the procedure of Underwriter's Laboratory Bulletin 94 entitled "Combustion Tests for Classification of Materials, UL-94." According to this procedure, the materials were classified as either UL-94 V-0, UL-94 V-1 or UL-94 V-2 on the basis of the tests results obtained for ten samples. The criteria for each of these flammability classifications according to UL-94, are, briefly, as follows:

V-0: the average period of flaming and /or smoldering after removing the igniting flame should not exceed five seconds and none of the samples should produce drips of particles which ignite absorbent cotton.

55 V-1: the average period of flaming and/or smoldering after removing the igniting flame should not exceed twenty-five seconds and none of the samples should produce drips of particles which ignite absorbent cotton.

V-2: the average period of flaming and/or smoldering after removing the igniting flame should not exceed twenty-five seconds and the samples may produce drips of burning particles which ignite absorbent cotton.

The following examples illustrate the preparation of certain compositions within the scope of this invention. They are not to be construed to limit the invention in any manner whatsoever. All parts, except as otherwise indicated, are by weight.

5 **Examples**

The formulations shown below in Tables 1, 2, and 3 were preblended and extruded on a 30:1 L/D Single Screw Extruder with HPM double-wave screw at barrel and die head temperature at 500-510 degrees F and 100 rpm screw speed. The extrudate was cooled through a water bath prior to pelletizing. Test parts were injection molded on a van
10 Dom molding machine with a set temperature of approximately 500 to 510 degrees F. The pellets were dried for 3-4 hours at 250° F. in a forced air circulating oven prior to injection molding.

The control experiments labeled A-M showed low CTI. Compared to the control experiments, the formulations of the invention, labeled 1-12, containing pyro/polyphosphates and sulfates or minerals showed improved CTI. The pyro/
15 polyphosphate are metal pyrophosphates, metal polyphosphates, metal acid pyrophosphates, or metal acid polyphosphates.

Articles which are molded from the formulated resins are suitable for use in or as electrical devices such as electrical outlets, circuit breakers, switches, fuse holders, lamp sockets, distributor caps, enclosures, or ignition coils. Such articles may be formed by conventional molding techniques.

TABLE 1: Controlled Experiments

Material	A	B	C	D	E	F	G
RESIN							
PBT 315 - (1)	39.00	32.50	28.85	29.30	35.40	32.45	29.10
PBT 195 - (2)	21.00	17.50	15.00	15.70	18.45	16.90	15.25
GLASS							
E-Glass - (3)	30.00	20.00	20.00	20.00	20.00	20.00	15.00
FR+SYNERGIST							
Br. Acrylate - (4)	8.00	8.00	8.00	8.00	8.00	8.00	8.00
Sb2O3 conc. - (5)			3.00		3.00	3.00	3.00
Sb2O3	2.00	2.00		2.00			
Mineral							
BaSO4		20.00	25.00	20.00			
Talc							
SAPP - (6)					15.00	15.00	25.00
Others							
EEA - (7)			0.15	5.00	0.15	4.50	4.50
Irganox 1076 - (8)						0.15	0.15
CTI (volts):	100.00	100.00	100.00	100.00	100.00	100.00	100.00
	225	275	350	375	325	375	325

UL94 (Flammability) @ 1.0mm	n/a	n/a	n/a	n/a	V-0	V-1	V-1
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- (1) Polybutylene Terephthalate Resin Mw 100,000
 (2) Polybutylene Terephthalate Resin Mw 36,000
 (3) 14 micron diameter glass
 (4) Poly(pentabromobenzyl Acrylate) Mw 15,000
 (5) 85% Sb2O3 and 15% olefinic binder
 (6) Sodium Acid Pyrophosphate
 (7) Polycopolymer of ethylene with 18% Ethyl Acrylate
 (8) Hindered Phenol Anti Oxidant

TABLE 2: Experiments That Show Minerals and Acid Pyrophosphate or Polyphosphate Synergy on CTL

	Material	1	2	3	4	5	6	7	8
RESIN	PBT 315	25.85	20.00	20.00	20.50	22.55	22.55	22.55	22.55
	PBT 195	13.50	20.05	20.05	20.50	22.50	22.50	22.50	22.50
GLASS	E-Glass	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00
FR+SYNERGIST	Br. Acrylate	8.00	6.80	6.80	6.80	6.80	6.80	6.80	6.80
	Sb2O3 conc.	3.00	3.00	3.00	2.55	3.00	3.00	3.00	3.00
	PTFE conc. - (9)		0.50	0.50		0.50	0.50	0.50	0.50
Mineral	BaSO4	20.00	25.00	25.00	25.00	20.00	20.00	20.00	20.00
	MgSO4								
	Clay								
	Mica								
	Wollastonite								
	Talc								
	SAPP	10.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00
	Sodium Hexametaphosphate								
Others	EEA	4.50	4.50	4.50	4.50	4.50	4.50	4.50	4.50
	Irganox 1076	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15
		100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
CTL (volts):		475	500	450	>600	450	425	425	>600

UL94 (Flammability) @ 1.0mm

(9) PTFE with some proprietary binder (50:50)

TABLE 3: Effects of Different Flame Retardants on CTI With and Without Minerals + Acid Pyrophosphate Synergist

Material	H	9	J	10	K	11	L	M	12
RESIN									
PBT 315	33.90	25.10	22.40	22.40	34.10	24.55	38.50	22.55	22.55
PBT 195	17.75	13.05	22.40	22.40	17.75	12.80	20.50	22.50	22.50
GLASS	20.00	15.00	15.00	15.00	20.00	15.00	30.00	17.55	12.55
FR+SYNERGIST									
BC58+Sb2O3 conc. - (10)	13.20	13.20	10.90	10.90					
PDBS-80 - (11)					10.00	10.00	9.00	12.25	12.25
Br. Epoxy - (12)					3.00	3.00	2.00	0.50	0.50
Br. Epoxy+Sb2O3 conc. - (13)									
Sb2O3 conc.			0.50	0.50					
Sb2O3									
PTFE conc.									
Mineral									
BaSO4		20.00	25.00	20.00		20.00		20.00	5.0
Talc				5.00	15.00	10.00			20.00
SAPP	15.00	10.00							
Others									
EEA		3.50	3.65	3.65		4.50	4.50	4.50	4.50
Irganox 1076	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15
	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

CTI (volts):	250	350	325	425	400	550	200	375	>600
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UL94 (Flammability) @ 1.0mm	V-2	V-0	V-0	V-0	V-2	V-2	V-0	V-0	V-0
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(10) Polycarbonate oligomer of Tetrabromobisphenol A, Sb2O3, and olefinic binder (67:20:13)

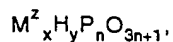
(11) Polydibromostyrene Mw 50,000

(12) Brominated epoxy Mw 40,000

(13) Brominated epoxy and Sb2O3 concentrate (75:25)

Claims

1. A flame retarded resin molding composition with enhanced electrical properties comprising a polyester resin a flame retarding amount of halogenated flame retardant, a mineral filler, and an effective amount of a pyro/polyphosphate selected from the group consisting of metal pyrophosphates, metal polyphosphates, metal acid pyrophosphates, metal acid polyphosphates and mixtures thereof for improving the electrical properties of said composition.
2. A flame retarded resin molding composition according to Claim 1, wherein said pyro/polyphosphate has the formula:



wherein M is a metal, z is from 1 to 5, x is a number from 1 to 12, y is a number from 0 to 12, n is a number from 2 to 10.

3. A flame retarded resin molding composition according to Claim 3 wherein the CTI of the final composition is greater than about 400 volts.
4. A flame retarded resin molding composition according to Claim 2 wherein M is a Group IA, IIA, IB or IIB metal.
5. A flame retarded resin molding composition according to Claim 2 wherein said pyro/polyphosphate is sodium acid pyrophosphate.
6. A flame retarded resin molding composition according to Claim 2 wherein M is sodium or potassium.
7. A flame retarded resin molding composition according to Claim 1 wherein said polyester is selected from the group consisting of poly(ethylene terephthalate) ("PET"), and poly(1,4-butylene terephthalate, ("PBT"), poly(ethylene naphthanoate) ("PEN"), poly(butylene naphthanoate), ("PBN) and (polypropylene terephthalate) ("PPT"), and mixtures thereof.
8. A flame retarded resin molding composition according to Claim 1 wherein said flame retardant is a poly (haloaryl-methacrylate), halogenated polystyrene or a poly (haloarylacrylate) flame retardant.
9. A flame retarded resin molding composition according to Claim 1 wherein mineral filler comprises a metal sulphate, talc, clay, mica, or wollastonite.
10. A flame retarded resin molding composition according to Claim 1 wherein said resin molding composition includes a reinforcing material.

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